

**Remedial Investigation at**  
**BOB'S DELI**

*Berlin, Vermont*

---

*May 1991*

*Prepared for:*

***Food and Gas, Inc.***

*P.O. Box 819*

*Burlington, Vermont 05401*

*Prepared by:*

***THE JOHNSON COMPANY, INC.***

*5 State Street*

*Montpelier, Vermont 05602*

*(802) 229-4600*

THE JOHNSON COMPANY, INC.

***Environmental Sciences and Engineering***

May 30, 1991

Walt Labounty and John Beroni  
Food and Gas, Inc.  
PO Box 819  
Burlington, Vermont 05401

Re: Report of Remedial Investigation at Bob's Deli, Barre-Montpelier Road, Montpelier, Vt.  
JCO No. 1-0247-1

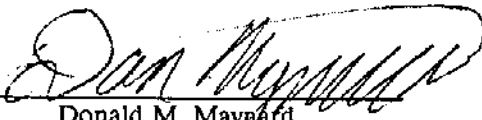
Dear Sirs:

We have completed our remedial investigation of the gasoline release at Bob's Deli on the Barre-Montpelier Road. Enclosed is a copy of our report detailing the results of the investigation. Upon your approval, we will also send a copy of the report to Bob Hazlam of the Petroleum Sites Management Section. It has been a pleasure working on this project for you. If you have further need of our services please do not hesitate to call me or our Vice President of Sciences, Chris Stone.

Sincerely,

THE JOHNSON COMPANY, INC.

By:



Donald M. Maynard  
Project Geologist

Enclosure

Reviewed by CTS

J:\PROJECTS\1-0247-1\FINAL RPT May 28, 1991 15:08 DMM

## EXECUTIVE SUMMARY

The Johnson Company was contracted by Food and Gas, Incorporated of Burlington, Vermont to perform a remedial investigation of the gasoline release which was discovered on March 26, 1991 at Bob's Deli on the Barre-Montpelier Road (Route 302) in Montpelier, Vermont. In the course of the investigation, a site map was developed, six monitoring wells were installed, five soil samples and seven water samples were analyzed for the presence of petroleum products, and an analysis of the extent and concentration of the hydrocarbon plume was developed. No free product was observed on the groundwater except in Monitoring Well MW1.

Based on the available data, The Johnson Company has determined that the primary source of the petroleum in the environment was a leaky seal in the unleaded gasoline pump sump pit. This seal has been replaced, which has probably stopped the release of gasoline to the environment.

The gasoline followed two primary pathways after release in the sump pit. A portion of the gasoline was transported along the supply line trench toward the service island. When this gasoline encountered the sewage pipe leading from Bob's Deli to the municipal sewer, it followed the sewer pipe trench and entered the municipal sewer. The amount of gasoline in the municipal sewer has dropped off since the leaky seal was replaced, and the release stopped. Another portion of the gasoline migrated downwards to the groundwater directly below the unleaded underground storage tank. This portion of the release was carried by groundwater toward the Stevens Branch of the Winooski River. This hydrocarbon plume has migrated across Route 302 and is currently located beneath the parking lot of the Vermont Department of Employment and Training.

The primary potential receptors in the vicinity of the release are the Stevens Branch, and a 12" diameter Water supply main which serves Barre Fire District #1. There is no evidence of contamination of either of these receptors at this time. A third receptor includes the municipal sewer, and potentially the buildings and houses connected to it.

Because of the light industrial nature of the area, and because of the heavy traffic load carried by Route 302, it is impractical to excavate the contaminated soil as a remediation technique. Because almost all of the area is covered by asphalt, and none of the buildings in the vicinity have basements, we do not feel that vapor extraction is a necessary remediation technique for this site. Because the release has been stopped, and the only free product observed (in monitoring well MW1) has been bailed to a thickness of less than 0.01 feet, we do not recommend "pump & treat" remediation technology.

We do recommend periodic monitoring of the petroleum concentrations in the groundwater, the sewer, and in the closest buildings attached to the municipal sewer to insure that the release has stopped, and to evaluate the rate of migration and degradation of the contaminant plume. We also recommend continued air monitoring and replacement of the petroleum collection boom in the sewer. Since the supply line from the unleaded tank to the service island is continually under pressure, we recommend the installation of a leak detection device on that line. We recommend a letter of information to the Montpelier Public Works Department and the Berlin Fire District informing them of the presence of petroleum products and contaminated soil in the vicinity of the 12" diameter force water main below Bob's Deli. We also recommend periodic inspection of the Stevens Branch for visual signs of contamination.

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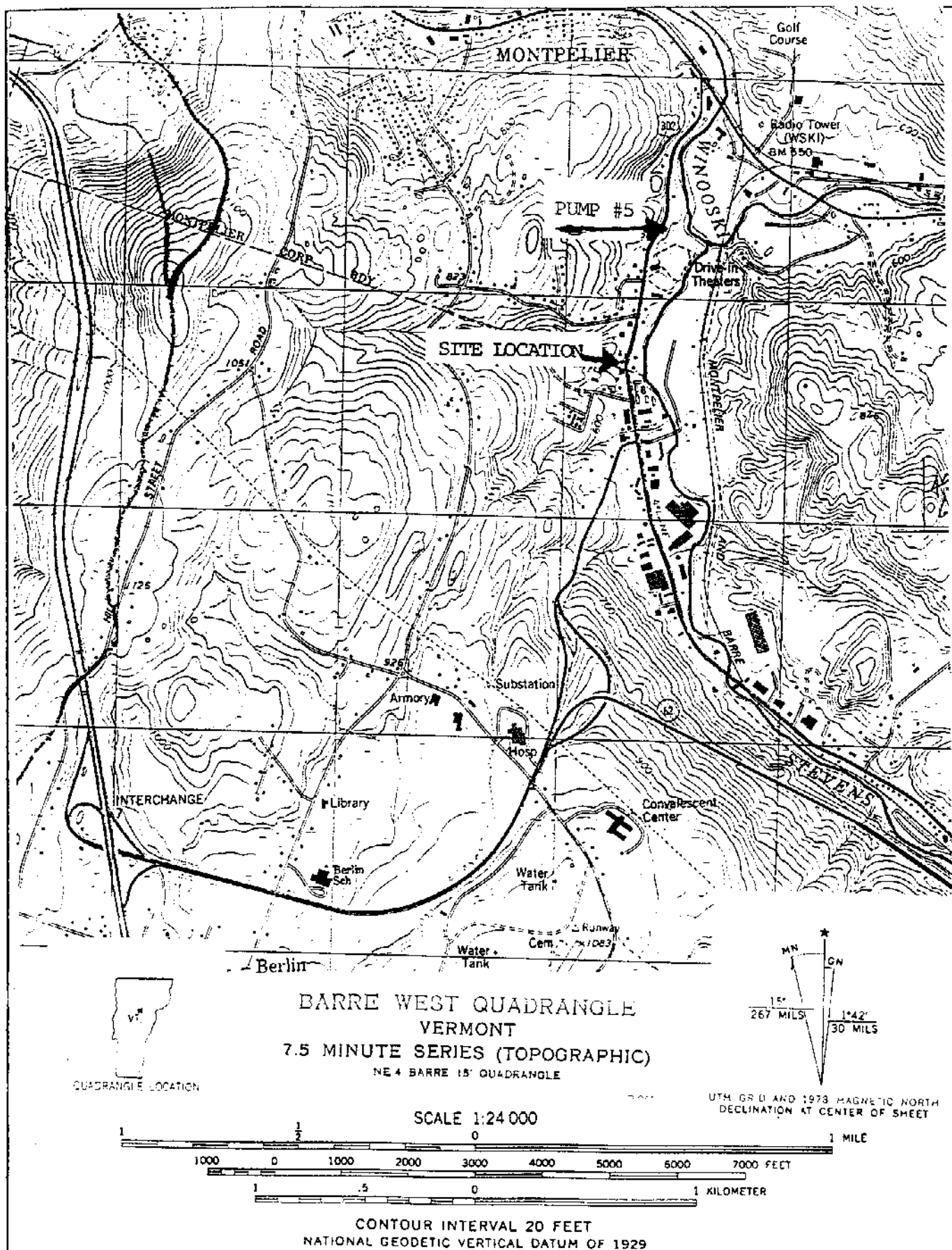
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## 1.0 INTRODUCTION

This document is a report of the results of a remedial investigation performed by The Johnson Company, Inc. for Food and Gas, Inc. of Burlington Vermont. Food and Gas, Inc. owns the gasoline tanks and distribution system at Bob's Deli on the Barre-Montpelier Road (Route 302) in Montpelier, Vermont (See Figure 1, Location Map). The building and property at Bob's Deli is owned by Bob Petrzeba of Montpelier, Vermont. There are six underground storage tanks (USTs) for gasoline at Bob's Deli. Two of the USTs are not currently being used, and two are linked together below ground (See Attachment 1, Site Plan). All of the USTs are single walled steel tanks. Three monitoring wells (MW1, MW2, and MW3) were installed in compliance with the Vermont Underground Storage Tank Regulations. The tank containing "super" and each of the connected tanks containing "plus" gasoline have a 4,000 gallon capacity. The supply lines to the service island for these tanks use a vacuum pump to pull the gasoline from the tanks to the dispensers. The tank containing unleaded gasoline has 12,000 gallons capacity. The gasoline from this tank is pumped under positive pressure to the service island. The unleaded pump is located in a sump pit above the center of the unleaded UST. The unleaded supply line has successfully passed a pressure test performed on March 27, 1991 by Northland Petroleum of Barre, Vermont, but has no leak detection device installed. On March 26, 1991 it was discovered that the unleaded pump had a bad seal, and was pumping gasoline into the unlined sump pit. The unleaded pump was shut down immediately, and about one gallon of free product was removed by bailing from monitoring well MW1. About five gallons of gasoline were removed from the sump pit at this time. The pump was repaired, and the free product in MW1 was bailed out two more times over the next three days, for a total of about five gallons recovered from MW1. A gasoline smell was reported in the bathroom of the neighboring building, S&L Auto Supply Inc. It was determined that the gasoline vapors were leaking into the bathroom around a faulty toilet seal, and that the source of the gasoline vapors was the Montpelier municipal sewer system. A strong gasoline smell was also evident in the cleanout of the Bob's Deli sewer line. The leaking toilet seal at S&L Auto was replaced, and a letter was sent by the Montpelier Public Works department to the owners of sewer connections between Bob's Deli and Pump Station #5. Free product was identified in the municipal sewer at Manhole #2, and petroleum recovery booms were installed on March 26, 1991 below Manhole #2 (Attachment 1) and near pump station #5 (Figure 1). The boom in Manhole #2 was replaced on April 1, 1991. No free product was observed near pump station #5. No free product thickness greater than 0.01' has been observed in any of the monitoring wells since March 29, 1991. A total of about 200 gallons was released into the sump pit based on an evaluation of the records.



## 2.0 DATA COLLECTION AND INTERPRETATION

Initial data collected by The Johnson Company included site history information from relevant parties, and location of underground utilities from a site visit, the Montpelier Public Works Department, and Dig Safe Personnel. Levels of volatile organic vapors were measured in the sewer manholes and the sump pit using a photoionization detector (PID). Water elevations and headspace PID readings were measured in each of the existing three monitoring wells, MW1, MW2, and MW3. The monitoring well and sewer locations are shown on the Site Plan, Attachment 1.

Following a review of this data and the drafting of a rough site plan, five monitoring well locations were proposed. These locations were approved verbally by Bob Hazlam of the DEC Petroleum Waste Management Division. The Johnson Company and the drilling contractor (Adams Engineering) then installed a total of six monitoring wells. Soil samples were collected during installation of five of the wells using standard split spoon sampling methods. The descriptions of these soil samples are included on the monitoring well logs in Appendix 1. The monitoring wells are constructed of flush coupled two inch diameter PVC, with factory slotted screens. The specific details of each well's completion are included in Appendix 1. One monitoring well, AP1, was installed using a driven steel casing with a disposable point. This well was installed to a depth of 20 feet below ground surface, but did not encounter the water table. The PVC pipe was removed and the wellbore was plugged with bentonite one week after installation.

Two attempts were made to hand auger into the gravel bedding of the sewer and water main pipes. These attempts were unsuccessful due to caving of the auger hole. No volatile organic vapors were measured in the hand auger holes or soils.

Five soils samples and seven groundwater samples were collected and analyzed for the presence of benzene, toluene, ethylbenzene, xylenes, (BTEX) and methyl tertiary butyl ether (MTBE). The BTEX compounds are typical constituents of gasoline, and the MTBE is used in unleaded gasoline as a lubricant.

### 2.1 HYDROGEOLOGY

There exist at least three aquifers below the vicinity of Bob's Deli. Two of these aquifers have been evaluated, but no data was collected from the bedrock aquifer. The upper aquifer is approximately three to ten feet thick and consists primarily of backfill and disturbed soils. The backfill includes a variety of grain sizes from angular 3/4" crushed stone to chunks of clay and silt. Based on the hand auger holes, this aquifer was dry in the area directly below Bob's Deli property on May 6, 1991. Approximately one foot of water was measured in the upper aquifer at monitoring well JCO1 on the same date. The direction

of groundwater flow in the upper aquifer is controlled by the geometry of the surface of the underlying clay aquitard, by irregularities in that surface due to manmade trenches and pits, and by recharge events. The water level and direction of groundwater flow in this aquifer is likely to vary seasonally. Underlying the upper aquifer is between three and seven feet of relatively impermeable blue grey clay and silt. This aquitard has been penetrated in several places by pipe trenches and tank pits. Areas of suspected penetration include the unleaded UST pit, and the 12" diameter water supply force main. The sewer and the gasoline supply pipe trenches probably did not penetrate the aquitard.

Below the clay and silt aquitard is a confined aquifer consisting of fine sand, some silt to fine and medium sand. This aquifer is at least eight feet thick. The bottom of this aquifer has not been documented, but from nearby topography is probably at least 50 feet below ground surface. The petroleum contamination in this aquifer extends from the unleaded UST, across Route 302 towards the Vermont State Employment and Training Center and the Stevens Branch. The direction of groundwater flow in this aquifer is primarily toward the east and the Stevens Branch. The recharge to this lower aquifer is probably mostly due to infiltration from streams near the valley wall.

## **2.2 RECEPTORS AND MIGRATION PATHWAYS**

There are three potential pathways by which receptors of the gasoline contamination can be affected. One pathway is by direct contact with gasoline contaminated water or soil. Since all of the known contamination is limited to areas below the ground surface, direct contact with the gasoline is not likely. There are two 55 gallon drums containing gasoline/water mixtures and about 10 cubic feet of contaminated soil in buckets and plastic bags stored on the site. These contaminated soils and liquids should be removed from the site as soon as possible and disposed of properly.

A second pathway of contamination migration is through the ground. Migration through the groundwater has occurred in the lower aquifer, and has spread dissolved gasoline over an area of about 20,000 square feet. The potential receptors for this contamination include the Stevens Branch, the buried 12" diameter water supply force main to the Berlin Fire district, and the Montpelier City sewer line. Evidence that contamination of the Stevens Branch due to this release may occur includes the direction of groundwater flow and observed contaminant transport from Bob's Deli towards the Stevens Branch. The edge of the contamination in the direction of the river was not determined in this investigation. However, detectable contamination of the river is not considered likely for the following reasons. There have been no seeps observed or evidence of gasoline contamination along the 50 foot high bank above the Stevens Branch or in the river itself. Based on measured groundwater elevations in the confined aquifer, the



groundwater flows into the Stevens Branch below the surface of the water. There has been no free product detected in any of the monitoring wells except MW1. In the absence of a free product phase, and considering the termination of the release, it is likely that the concentration of the gasoline slug in the aquifer will decrease over time and distance.

The second potential receptor, the 12" force water main for the Berlin Fire District has a normal operating pressure of about 200 psi. It is a ductile iron pipe, presumably with neoprene gaskets. The main is buried at a depth of about seven feet below ground surface. The invert of the pipe is therefore about two feet above the water level in the confined aquifer. The bottom of the clay aquitard near the water main is about eight feet below ground surface. Therefore the force main trench must have been cut through the aquitard. It is likely that a portion of the released gasoline traveled along the preferred migration route of the gasoline supply line trench. This trench was not excavated below the bottom of the clay aquitard, and therefore can act as a channel in the less permeable soils, through which the gasoline preferentially flows. This probably allowed gasoline to reach the edge of the disturbed soil in the force main trench, and migrate down through the trench to the water table. It is likely therefore, that the water supply force main is surrounded by gasoline contaminated soils. However, since the force main is above the water table, it is unlikely that the pipe has been sitting in a pool of free product. There is the potential for degradation of the neoprene seals under prolonged contact with gasoline. There is little or no danger of contamination of the water supply under normal operating conditions. If the force main develops a leak however, excavation of the main will almost certainly involve dealing with gasoline contaminated soils, and may involve an explosion hazard due to volatile organic vapors. The contaminated soils will also create difficulties in maintaining water purity if a pipe section needs to be replaced. In addition, if the pressure in the line is not maintained, then gasoline may migrate into the water supply.

The third receptor for contamination through the ground is the Montpelier City sewer. This sewer begins at Bob's Deli and continues down Route 302 towards Montpelier. PID readings in manholes #1 and #2 indicate that there is still gasoline present in the sewer (see Table 1). At this time there is an oil boom located in manhole #2, but there is no visible sign of gasoline in the sewer. The oil boom has been removed from pump station #5 (see Figure 1 for location), and there is no longer any smell of gasoline at that location. The probable migration path for the gasoline into the sewer begins along the gasoline supply line trench (see Attachment 1). This trench intersects the trench which was excavated for the Bob's Deli connection to the municipal sewer pipe. The Bob's Deli sewer line is lower than the gasoline supply line based on relative elevations observed in the sewer cleanout and manhole, and in the sump pit. Therefore, when the gasoline traveling along the disturbed soils in the supply line trench

encountered the sewer trench, much of it migrated downwards and followed the sewer trench. The bottom of the sewer trench is not below the bottom of the aquitard, so it too acts as a preferential pathway for migration. It is likely that the gasoline is entering the municipal sewer pipe at the junction of that pipe and the Bob's Deli sewer line 10 feet from manhole #1. The base of the municipal sewer line is probably above the base of the aquitard as well. The municipal sewer is bedded in crushed 3/4" stone, supplying an optimum pathway for gasoline migration along its trench.

There is a second water supply force main and a sewer force main on the east side of Route 302 as well. There is also a 4" PVC water supply pipe on the east side of Route 302. These pipes are most likely located above the contaminated confined aquifer, and are probably not in contact with the gasoline.

The third pathway by which receptors can be affected by the gasoline release is by volatile organic vapors. The dangers of these vapors are twofold. One danger is the explosive nature of the vapors. Concentrations above 25% of the lower explosive limit (LEL) were measured in the sump pit on April 30, 1991, but have since dropped off to well below 25% of the LEL. Concentrations measured in the sewer have not been observed above or near 25% of the lower explosive limit. Therefore there is little danger of explosion due to concentration of the vapors in the municipal sewer. The second hazard of volatile organic vapors is inhalation. The OSHA standard threshold limit value (TLV) for gasoline is 300 parts per million (ppm). Concentrations measured with the PID in the municipal sewer have approached this value but have not exceeded it. Concentrations in the sump pit exceed this value on April 30, 1991, but have since declined to less than the TLV. The vapor concentrations appear to be declining since April. Since most of the contaminated area is covered with pavement, and there are no basements in the vicinity of the contamination, human exposure to the gasoline vapors is limited to the sewers and the sump pit. Both the sewers and the sump pit are closed with steel covers. The covers have 1" diameter holes which will help prevent the excessive buildup of vapors. As is evidenced by the experiences of S&L Auto, it is possible for the vapors to enter a building through improperly constructed plumbing. Normally the migration of vapors through waste lines is prevented by traps.

### **2.3 MONITORING WELLS AND CHEMICAL ANALYSIS**

Five monitoring wells were installed using a hollow stem auger in addition to the three existing wells. Split spoon soil samples were collected during installation and tested with the PID in the field. The results of these tests and the well logs are included in Appendix 1. Samples of the soils were stored in jars, and the headspace concentrations were measured with the PID two to four hours after collection. These results are presented in Table 1. All five of the new wells, JCO1 to JCO5, were developed by

Table 1

Results of field measurements of volatile organic vapors

LOCATION	DATE	PID (ppm)	% LEL
Sewer Manhole #1	4/30/91	294	2
Sewer manhole #1	4/29/91	178	
Sewer manhole #2 (Had been opened the day before)	4/30/91	6	0
Sewer Manhole #2	5/29/91	102	
Sewer Cleanout at Bob's	5/29/91	188	
Sump Pit	4/30/91	560	25+
Sump Pit	5/29/91	268	
MW1 (Well Headspace)	4/30/91	214	
MW2 (Well Headspace)	4/30/91	142	
MW3 (Well Headspace)	4/30/91	0.4	
JCO1 (Maximum Soil Headspace)	5/6/91	0	
JCO2 (Maximum Soil Headspace)	5/6/91	1.5	
JCO3 (Maximum Soil Headspace)	5/6/91	475	
JCO4 (Maximum Soil Headspace)	5/7/91	150	
JCO5 (Maximum Soil Headspace)	5/7/91	4.5	

pumping or bailing at least five well volumes of water. One monitoring well, AP1, was installed using a driven casing and a disposable point. This well did not have any water in it, and it was decommissioned one week after installation.

Water levels and non-aqueous phase liquid (NAPL) thicknesses were measured in the monitoring wells to the nearest 0.01 foot. The relative elevations of the wells were measured with an autolevel to the nearest 0.01 foot. A contour map of the piezometric surface in the confined aquifer is displayed in Attachment 1. The slope of the piezometric surface is about 10% between MW1 and JCO3. The slope increases towards the river, and decreases toward the USTs. The lateral distance from the sump pit to the

Stevens Branch along the centerline of the contamination slug is about 300'. The hydraulic conductivity and porosity of the confined aquifer can be estimated by comparing the soil grain size gradation with published values for similar soils. We estimate the hydraulic conductivity of the aquifer to be between 5 and 10 feet per day (fpd). We estimate the porosity of the aquifer to be 30%. Assuming that the rate of migration of the gasoline through the ground will be similar to the rate of groundwater movement, it is possible to estimate the travel time from the sump pit to the river. Using Darcy's equation for saturated flow through porous media the travel time is calculated as follows:

$$T = (L \times \Theta) / (k \times i)$$

Where:

T is travel time in days

L = 300', distance from sump pit to river

$\Theta$  = 0.30, porosity of confined aquifer

$5 < k < 10$  fpd, hydraulic conductivity of aquifer

i = 0.10, slope of piezometric surface

$$(300' \times 0.30) / (5 \text{ fpd} \times 0.10) > T > (300' \times 0.30) / (10 \text{ fpd} \times 0.10)$$

$$180 \text{ days} > T > 90 \text{ days}$$

If the gasoline contamination reaches the river through the groundwater, it will probably do so within 90 to 180 days of the initial release.

The distance from the sump pit to monitoring well JCO3 is about 120'. Based on the above equation, travel time to JCO3 should be between 36 and 72 days.

Five soil samples, one from each of the new monitoring wells, were collected and sent to Endyne, Inc. in Williston, Vermont. The samples were analyzed by Endyne for purgeable aromatic compounds using EPA method 8020. No aromatic compounds were detected in the soil samples from wells JCO1, JCO2, and JCO5. The soil samples from JCO3 and JCO4 had concentrations of total BTEX almost 3 parts per million (ppm) for JCO4, and above 1,800 ppm for JCO3 (see Table 2).

Water samples were collected from MW2, MW3, and JCO1 through 5. No sample was collected for analysis from MW1 because there was 0.01' free product in that well at the time of sampling. These water samples were sent to Endyne, Inc. and analyzed for BTEX and MTBE using the gas chromatograph (gc) method. A trip blank was also collected and analyzed for the same parameters. No measurable levels

of BTEX or MTBE were found in the water samples from wells JCO1, JCO2, and JCO5. Less than 3 parts per billion (ppb) benzene and MTBE were found in the water from the upgradient well MW3. 15.8 ppm total BTEX was found in the JCO4 water, and 33.7 ppm in the MW2 sample. 87.3 ppm total BTEX was found in the water sample from JCO3.

It is apparent from this data that JCO4 and MW2 are near the edges of the contaminated area. The high levels of BTEX in the JCO3 soil sample relative to the JCO3 water sample may indicate that the slug of contamination has already passed that point.

Table 2  
Analytical Results for Bob's Deli

Sample	Date	Sample Type	Benzene (ppb)	Ethylbenzene (ppb)	Toluene (ppb)	Xylenes (ppb)	MTBE (ppb)
JCO1 10-11'	5/6/91	Soil	ND	ND	ND	ND	ND
JCO2 13-13.4'	5/6/91	Soil	ND	ND	ND	ND	ND
JCO3 16-18'	5/6/91	Soil	56,000.	203,000.	569,000.	978,000.	10,500.
JCO4 11-14'	5/7/91	Soil	ND	343.	855.	1,750.	233.
JCO5 8.5-9'	5/7/91	Soil	ND	ND	ND	ND	ND
JCO1	5/14/91	Water	ND	ND	ND	ND	ND
JCO2	5/14/91	Water	ND	ND	ND	ND	ND
JCO3	5/14/91	Water	15,500.	3,860.	48,800.	19,100.	1,290.
JCO4	5/14/91	Water	2,410.	1,420.	5,990.	6,160.	1,520.
JCO5	5/14/91	Water	ND	ND	ND	ND	ND
MW2	5/14/91	Water	9,710.	1,900.	12,200.	9,890.	5,480.
MW3	5/14/91	Water	2.65	ND	ND	ND	2.64

ND indicates not detected in analysis.

### 3.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions may be drawn from the available data:

A gasoline release has occurred, probably from a failed seal in the pump for the unleaded gasoline tank.

The initial release occurred sometime before March 26, 1991.

The pump has been repaired, the supply lines pressure tested, and the release has probably been stopped.

A slug of contaminated groundwater is moving toward the Stevens Branch through the confined aquifer.

The gasoline entered the confined aquifer below the unleaded UST and possibly through the 12" water supply force main trench.

The highest concentrations in the slug have already passed by monitoring well JCO3.

If any gasoline does reach the Stevens Branch, it will probably do so before October, 1991.

There is a 12" diameter ductile iron water supply force main which passes below the Bob's Deli property.

This force main has probably been exposed to gasoline contamination.

No receptors were identified which will be affected by the contamination in the confined aquifer.

The Montpelier municipal sewer has been contaminated by gasoline from the release.

The gasoline migrated to the sewer in the upper aquifer along preferential pathways caused by trenching for gasoline supply lines and sewer lines.

The gasoline vapor concentration in the sewer is below TLVs and 25% of the LEL.

There has been no free product observed since April 1, 1991 except for less than 0.01' NAPL thickness in MW1.

Concentrations of total BTEX have been measured in the soil up to 1,800 ppm.

The following Recommendations have been made:

Visually monitor the Stevens Branch for gasoline sheen on a regular basis until October, 1991.

Monitor concentration of volatiles in the groundwater, the sewer, and nearby buildings connected to the sewer on a regular basis until levels drop to acceptable limits.

(This monitoring of groundwater can be accomplished using PID headspace readings on samples from monitoring wells)

Write a letter to the Montpelier Public Works and to The Berlin Fire District, informing them of the danger of excavation in the contaminated soils in the vicinity of the 12" water supply force main.

Maintain and inspect regularly the oil boom in Manhole #2 until PID readings in the sewer return to ambient levels.

Regularly measure water levels and NAPL thickness in the monitoring wells to monitor seasonal groundwater changes.

Install a leak detector on the unleaded supply line, and regularly inspect sump pit.

Remove and dispose of contaminated soils and liquids stored on-site.

## **Appendix 1**

### **Monitoring Well Logs**



The Johnson Company, Inc.  
Environmental Sciences and Engineering  
5 State Street  
Montpelier, Vermont 05602

# DRILLING LOG

## WELL # JCO1

Project: Bob's Deli  
Location: Montpelier, Vermont  
Job # 1-0247-1  
Logged By: DMM  
Date Drilled: 5/6/91  
Driller: Adams Engineering  
Drill Method: Hollow Stem Auger

Casing Type: PVC  
Casing Diameter: 2.0 in.  
Casing Length: 4.9 ft.  
Screen Type: PVC  
Screen Diameter: 2.0 in.  
Screen Length: 9.0 ft.  
Slot Size: 0.010 in.

Total Pipe: 13.9 ft.  
Stick Up: -0.4 ft.  
Total Hole Depth: 15.1 ft.  
Well Guard Length: 1.5 ft.  
Initial Water Level: 13.51 ft.  
Surface Elevation: 95.26  
T.O.C. Elevation: 95.86

■ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					
4					
3					
2					
1					
0		Well Guard			
1		Cement			Asphalt.
2		Backfill		0	
3		Bentonite			Fine sand some silt little subround gravel, pebbles.
4					
5				0	2.7-7.5 12,8,9,5,6 1.0' recovery 0.3' grey damp silt, little fine sand 0.25' Grey dry coarse gravel and angular granite pebbles. 0.45' Grey dry fine and medium sand some granite gravel, pebbles.
6					
7					
8		Screen			
9		Sand Pack			8.7-13.7 12,7,4,5,7 3.0' recovery 1.5' light brown saturated fine sand some silt trace angular shale pebbles 1.5' blue grey damp silt and clay sharp horizontal contact
10				27	
11					
12					
13					
14					
15				17	14.1-16.1 1,1,1,2 2.0' recovery blue grey moist clay and silt.
16					
17					

The Johnson Company, Inc.  
Environmental Sciences and Engineering  
5 State Street  
Montpelier, Vermont 05602

# DRILLING LOG WELL # JCO2

Project: Bob's Deli  
Location: Montpelier, Vermont  
Job # 1-0247-1  
Logged By: BMM  
Date Drilled: 5/6/91  
Driller: Adams Engineering  
Drill Method: Hollow Stem Auger

Casing Type: PVC  
Casing Diameter: 2.0 in.  
Casing Length: 10.5 ft.  
Screen Type: PVC  
Screen Diameter: 2.0 in.  
Screen Length: 3.0 ft.  
Slot Size: 0.010

Total Pipe: 20.0 ft.  
Stick Up: -0.3 ft.  
Total Hole Depth: 20.3 ft.  
Well Guard Length: 1.5 ft.  
Initial Water Level: 10.91 ft.  
Surface Elevation: 98.76  
T.O.C. Elevation: 97.76

■ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					
4					
3					
2					
1					
0					
1	Well Guard				
2	Cement			5.6	coarse sand and gravel some subround cobbles.
3					
4					
5	Backfill			0	3.2-8.2 5,5,10,7,8 4.0' recovery
6					1.5' blue grey humid massive clay and silt
7					2.5' brown and grey dry silt some fine sand, clay little subround pebbles, gravel, wood chips.
8	Bentonite			0	
9				7.6	
10					
11					
12					
13					
14					
15	Sand Pack			7.5	8.0-11.0' 13,18,22 3.0' recovery blue grey dry to damp silt and clay distinct fine orange mottles 9-10'
16					
17	Screen				
18					
19					
20					8-13.4' 20,17,28 2.0' recovery back in same split spoon hole.
21					1.4' blue grey damp clay
22					0.6' grey saturated fine sand trace silt few angular pebbles. sharp orange horizontal laminations.
23					
24					
25					
26					
27					
28					13.5-18.5 10,14,18,20,22 grey saturated fine sand little silt, trace subangular pebbles. horizontal laminations.
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					

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# DRILLING LOG

## WELL # JCO3

Project: Bob's Deli  
Location: Montpelier, Vermont  
Job # 1-0247-1  
Logged By: DMM  
Date Drilled: 5/6/91  
Driller: Adams Engineering  
Drill Method: Hollow Stem Auger

Casing Type: PVC  
Casing Diameter: 2.0 in.  
Casing Length: 13.7 ft.  
Screen Type: PVC  
Screen Diameter: 2.0 in.  
Screen Length: 4.5 ft.  
Slot Size: 0.010

Total Pipe: 18.7 ft.  
Stick Up: +0.5 ft.  
Total Hole Depth: 20.5 ft.  
Well Guard Length: 1.5 ft.  
Initial Water Level: 12.25 ft.  
Surface Elevation: 97.41  
T.O.C. Elevation: 97.11

■ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					
4					
3					
2					
1					
0					
1		Well Guard			
2		Cement			grey humid fine sand some silt, angular gravel.
3					
4					
5					
6					4.4-9.4 5,5,7,7,7 3.5' recovery
7		Backfill			0.4' grey humid fine sand some silt
8					3.1' brown dry to humid coarse and medium sand some subangular gravel little pebbles.
9					
10					
11					
12				5.6	
13					9.4-14.4 6,6,7,8,11 no recovery
14					soft moist blue clay spun up on auger blades
15		Bentonite			
16		Screen		47	
17		Sand Pack			
18					14.4-18 3,8,12,11,ref. 3.5' recov.
19					1.5' grey moist silt and clay.
20					1.0' black wet silt and clay, heavy gas smell.
21					1.0' dark grey saturated fine sand some silt, massive.
22					rock at 18'
23					
24					
25					
26					
27					18.5-20.5 2,2,4,4 1.0' recovery
28					grey saturated fine sand little silt, strong gas smell.
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					

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# DRILLING LOG

## WELL # JCO4

Project: Bob's Deli  
Location: Montpelier, Vermont  
Job # 1-0247-1  
Logged By: DMM  
Date Drilled: 6/7/91  
Driller: Adams Engineering  
Drill Method: Hollow Stem Auger

Casing Type: PVC  
Casing Diameter: 2.0 in.  
Casing Length: 9.9 ft.  
Screen Type: PVC  
Screen Diameter: 2.0 in.  
Screen Length: 4.5 ft.  
Slot Size: 0.010

Total Pipe: 14.9 ft.  
Stick Up: -0.5 ft.  
Total Hole Depth: 15.2 ft.  
Well Guard Length: 1.5 ft.  
Initial Water Level: 9.90 ft.  
Surface Elevation: 99.71  
T.O.C. Elevation: 99.41

■ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					
4					
3					
2					
1					
0		Well Guard			
1		Cement			
2				0	grey humid to damp fine sand and silt little gravel, pebbles trace medium sand.
3					
4					
5		Backfill			4.1-9.1 11,12,12,16,25 4.0' recov. 0.5' grey dry silt and fine sand some angular pebbles. sharp contact
6				0	3.0' tan to grey humid to moist massive silt some clay.
7					0.5' grey and black damp fine sand trace silt, medium sand. horizontal laminations.
8		Bentonite			
9					
10					9.1-14.1 10,22,17,19,16 3.5' recov. 3.0' grey wet fine sand some silt few shale pebbles. sharp horizontal contact. very strong gas odor.
11				0.0	0.5' tan wet fine and medium sand massive.
12		Sand Pack			
13		Screen			
14					
15					
16					
17					

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# DRILLING LOG WELL # JCO5

Project: Bob's Deli  
Location: Montpelier, Vermont  
Job # 1-0247-1  
Logged By: DMM  
Date Drilled: 5/7/91  
Driller: Adams Engineering  
Drill Method: Hollow Stem Auger

Casing Type: FVC  
Casing Diameter: 2.0 in.  
Casing Length: 9.8 ft  
Screen Type: PVC  
Screen Diameter: 2.0 in.  
Screen Length: 4.5 ft  
Slot Size: 0.010

Total Pipe: 14.8 ft.  
Stick Up: -0.3 ft.  
Total Hole Depth: 15.1 ft.  
Well Guard Length: 1.5 ft.  
Initial Water Level: 11.12 ft.  
Surface Elevation: 98.65  
T.O.C. Elevation: 98.38

■ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	FID Reading	Description
5					
4					
3					
2					
1					
0		Well Guard			
1		Cement			
2				1	brown humid medium sand and gravel some fine sand, silt, pebbles.
3					
4		Backfill		1	grey damp fine sand some silt
5					4-9' 7,12,13,18,+30 4.5' recov. 4.0' grey damp silt and clay. 45 degree bands of pink, sharp horizontal lower contact.
6				1	0.5' grey wet fine sand little silt, medium sand
7					
8		Bentonite			
9					
10					9.1-14.1' 24,29,26,27,27 no recovery wet core barrel, faint gas whiffs.
11					
12		Sand Pack		1.5	
13		Screen			
14					14.1-16.1' 3,3,8,5 1.0' recovery tan grey saturated medium and fine sand, few angular gravel, saturated.
15				1	
16					
17					

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**DRILLING LOG**  
**WELL # AP1**

Project: Bob's Deli  
Location: Montpelier, Vermont  
Job # 1-0247-1  
Logged By: DMM  
Date Drilled: 5/7/91  
Driller: Adams Engineering  
Drill Method: Driven Point

Casing Type: n/a  
Casing Diameter:  
Casing Length:  
Screen Type: n/a  
Screen Diameter:  
Screen Length:  
Slot Size: n/a

Total Pipe: 0.0 ft.  
Stick Up: 0.0 ft.  
Total Hole Depth: 19.3 ft.  
Well Guard Length: 0.0 ft.  
Initial Water Level: None  
Surface Elevation: 95.89  
T.O.C. Elevation: n/a

■ = Sampled Interval

Sheet 1 of 1

Depth (feet)	Well Construction	Notes	Geology	PID Reading	Description
5					
4					
3					
2					
1					
0					
1					
2					
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## **Appendix 2**

### **Analytical Results**



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LABORATORY REPORT

THE JOHNSON CO., INC.  
MONTPELIER, VERMONT

EPA METHOD 8020 -- PURGEABLE AROMATICS (SOLIDS)

CLIENT: Johnson Company  
PROJECT NAME: Walt LaBounty/Bob's Deli  
REPORT DATE: May 23, 1991      ANALYSIS DATE: May 19, 1991  
SAMPLER: Don Maynard      STATION: JCO5 8.5-9  
DATE SAMPLED: May 6-7, 1991      REF. #: 19,564  
DATE RECEIVED: May 8, 1991      TIME SAMPLED: 11:30

Parameter

Concentration (ug/kg)<sup>1</sup>  
dry weight

Benzene	ND <sup>2</sup>
Chlorobenzene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
Ethylbenzene	ND
Toluene	ND
Xylenes	ND
MTBE	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

- 1 Method 8020 detection limit is 5 ug/kg
- 2 None detected

Reviewed by Suzanne M. Gendron





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LABORATORY REPORT

EPA METHOD 8020 -- PURGEABLE AROMATICS (SOLIDS)

THE JOHNSON CO. INC.  
WILLISTON, VERMONT

CLIENT: Johnson Company  
PROJECT NAME: Walt LaBounty/Bob's Deli  
REPORT DATE: May 23, 1991      ANALYSIS DATE: May 19, 1991  
SAMPLER: Don Maynard      STATION: JCO4 11-14  
DATE SAMPLED: May 6-7, 1991      REF. #: 19,565  
DATE RECEIVED: May 8, 1991      TIME SAMPLED: 9:20

Parameter

Concentration (ug/kg)<sup>1</sup>  
dry weight

Benzene	ND <sup>2</sup>
Chlorobenzene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
Ethylbenzene	343.
Toluene	855.
Xylenes	1,750.
MTBE	233.

NUMBER OF UNIDENTIFIED PEAKS FOUND: 10

NOTES:

- 1 Method 8020 detection limit is 5 ug/kg
- 2 None detected

Reviewed by

Suzanne M. Benneche



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LABORATORY REPORT

EPA METHOD 8020 -- PURGEABLE AROMATICS (SOLIDS)

CLIENT: Johnson Company  
PROJECT NAME: Walt LaBounty/Bob's Deli  
REPORT DATE: May 23, 1991      ANALYSIS DATE: May 19, 1991  
SAMPLER: Don Maynard      STATION: JCO1 10-11  
DATE SAMPLED: May 6-7, 1991      REF. #: 19,566  
DATE RECEIVED: May 8, 1991      TIME SAMPLED: 9:00

Parameter

Concentration (ug/kg)<sup>1</sup>  
dry weight

Benzene	ND <sup>2</sup>
Chlorobenzene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
Ethylbenzene	ND
Toluene	ND
Xylenes	ND
MTBE	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

- 1 Method 8020 detection limit is 5 ug/kg
- 2 None detected

Reviewed by

Suzanne M. French



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LABORATORY REPORT

THE JOHNSON CO., INC.  
MONTPELIER, VERMONT

EPA METHOD 8020 -- PURGEABLE AROMATICS (SOLIDS)

CLIENT: Johnson Company  
PROJECT NAME: Walt LaBounty/Bob's Deli  
REPORT DATE: May 23, 1991      ANALYSIS DATE: May 19, 1991  
SAMPLER: Don Maynard      STATION: JCO3  
DATE SAMPLED: May 6-7, 1991      REF. #: 19,567  
DATE RECEIVED: May 8, 1991      TIME SAMPLED: 16:00

Parameter

Concentration (ug/kg)<sup>1</sup>  
dry weight

Benzene	56,000.
Chlorobenzene	ND <sup>2</sup>
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
Ethylbenzene	203,000.
Toluene	569,000.
Xylenes	978,000.
MTBE	10,500.

NUMBER OF UNIDENTIFIED PEAKS FOUND: 15

NOTES:

- 1 Method 8020 detection limit is 5 ug/kg
- 2 None detected

Reviewed by

Suzanne M. Grenoble



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LABORATORY REPORT

EPA METHOD 8020 -- PURGEABLE AROMATICS (SOLIDS)

CLIENT: Johnson Company  
PROJECT NAME: Walt LaBounty/Bob's Deli  
REPORT DATE: May 23, 1991      ANALYSIS DATE: May 19, 1991  
SAMPLER: Don Maynard      STATION: JCO2 13-13.4  
DATE SAMPLED: May 6-7, 1991      REF. #: 19,568  
DATE RECEIVED: May 8, 1991      TIME SAMPLED: 12:00

<u>Parameter</u>	<u>Concentration (ug/kg)<sup>1</sup></u> <u>dry weight</u>
Benzene	ND <sup>2</sup>
Chlorobenzene	ND
1,2-Dichlorobenzene	ND
1,3-Dichlorobenzene	ND
1,4-Dichlorobenzene	ND
Ethylbenzene	ND
Toluene	ND
Xylenes	ND
MTBE	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

- 1 Method 8020 detection limit is 5 ug/kg
- 2 None detected

Reviewed by

Suzanne M. Hendrick



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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: Trip Blank  
REF.#: 19,706  
TIME SAMPLED: 7:00

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<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	TBQ 1
Toluene	1.37
Ethylbenzene	ND 2
Xylenes	ND
MTBE	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

- 1 Trace below quantitation limit
- 2 Compound not detected in analysis

Reviewed by Suzanne M. Hendake



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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: MW 2  
REF.#: 19,707  
TIME SAMPLED: 8:50

<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	9,710.
Toluene	12,200.
Ethylbenzene	1,900.
Xylenes	9,890.
MTBE	5,480.

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NUMBER OF UNIDENTIFIED PEAKS FOUND: 13

Reviewed by

Suzanne M. Hendrick



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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: MW 3  
REF.#: 19,708  
TIME SAMPLED: 10:35

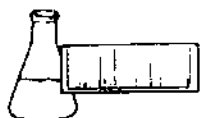
<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	2.65
Toluene	ND <sup>1</sup>
Ethylbenzene	ND
Xylenes	ND
MTBE	2.64

NUMBER OF UNIDENTIFIED PEAKS FOUND: 4

NOTES:

1 Compound not detected in analysis

Reviewed by Suzanne M. Hendake



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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: JCO-1  
REF.#: 19,709  
TIME SAMPLED: 12:20

<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	ND <sup>1</sup>
Toluene	ND
Ethylbenzene	ND
Xylenes	ND
MTBE	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 3

NOTES:

1 Compound not detected in analysis

Reviewed by

Suzanne M. Hendahl





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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: JCO-2  
REF.#: 19,710  
TIME SAMPLED: 11:10

<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	ND <sup>1</sup>
Toluene	ND
Ethylbenzene	ND
Xylenes	ND
MTBE	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

1 Compound not detected in analysis

Reviewed by Suzanne M. Brenden



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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: JCO-3  
REF.#: 19,711  
TIME SAMPLED: 11:40

<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	15,500.
Toluene	48,800.
Ethylbenzene	3,860.
Xylenes	19,100.
MTBE	1,290.

NUMBER OF UNIDENTIFIED PEAKS FOUND: 13

Reviewed by

Suzanne M. Grenade



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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: JCO-4  
REF.#: 19,712  
TIME SAMPLED: 9:50

<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	2,410.
Toluene	5,990.
Ethylbenzene	1,420.
Xylenes	6,160.
MTBE	1,520.

NUMBER OF UNIDENTIFIED PEAKS FOUND: 10

Reviewed by Suzanne M. Drenth



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LABORATORY REPORT

GC METHOD -- BTEX (BENZENE, TOLUENE, ETHYLBENZENE, XYLENES)

CLIENT: Johnson Company  
PROJECT NAME: Bob's Deli  
REPORT DATE: May 23, 1991  
SAMPLER: Warren P. Davey  
DATE SAMPLED: May 14, 1991  
DATE RECEIVED: May 15, 1991

ANALYSIS DATE: May 22, 1991  
STATION: JCO-5  
REF.#: 19,713  
TIME SAMPLED: 9:20

<u>Parameter</u>	<u>Concentration (ug/L)</u>
Benzene	ND 1
Toluene	ND
Ethylbenzene	ND
Xylenes	ND
MTBE	ND

NUMBER OF UNIDENTIFIED PEAKS FOUND: 0

NOTES:

1 Compound not detected in analysis

Reviewed by Suzanne M. Frenschke